of the wide channel. Thus, placement of the wide data channels was considered first in developing the proposed band plan. There are only two high speed data channel edges that border other uses. This concept is maintained during the transition period if one of the existing TV channels is occupied in a specific location by having the band plan for the current upper TV channel be a mirror image of that for the lower TV channel.

- These borders initially are against an undefined reserve band, which NPSTC proposes to be assigned regionally to meet regional needs depending upon the "mix" of voice/slow speed data and high speed data requirements in a specific region. This should allow some time for a standards process to develop the specific technical parameters for the high speed data channels. Thus these unknown parameters will be better defined before adjacent channel assignments must be made.

31. Finally, the Commission asks about carrying data over voice channels. NPSTC notes that the Commission's current practice of allowing the regional planning and frequency coordination processes to make such assignments in other bands has generally worked well. NPSTC proposes that 12.5 kHz voice channels be permitted to carry data at a minimum gross rate of 9.6 kbps, with exception as defined through the planning processes. The band plan presented in Appendix A has further subdivided two pairs of 150 kHz high speed channels into 25 kHz medium speed channels for assignment by the individual areas to applications with a minimum gross data rate of 19.2 kbps.

VII. CHANNEL REQUIREMENT

32. In paragraphs of the Notice 67-70, the Commission discusses channel requirements. NPSTC, in Appendix A, recommends a specific channeling plan that is discussed in detail elsewhere in this report. Specifically with respect to interoperability, NPSTC is proposing 2 MHz of spectrum for use in both paired (2 frequency) mobile relay and simplex, as follows:

1. Two (2) paired wideband (150 kHz bandwidth, ≥ 384 kbps data rate) digital video channel, total 0.600 MHz;
2. Two (2) paired wideband (150 kHz bandwidth, ≥ 384 kbps data rate) digital data channel, total 0.600 MHz;
3. Twenty (20) paired voice/slow speed (12.5 kHz bandwidth, ≥ 9.6 kbps) data channels, total 0.500 MHz with use restrictions as follows:
    - Two (2) paired coordination channels (available for both Public Safety and Public Service eligibles);
    - Two (2) paired Emergency Medical Services channels (Public Safety only);
    - Two (2) paired Fire channels (Public Safety only);
    - Two (2) paired Law Enforcement channels (Public Safety only);
    - Two (2) paired Public Safety/Public Service shared general access channels
    - Ten (10) paired tactical channels (Public Safety only)
4. Twenty-four (24) simplex channels for tactical on-scene communications; total 0.300 MHz, as follows:

- Six (6) frequencies for Public Safety/Public Service shared general access
- Eighteen (18) frequencies for Public Safety only use

VIII. EQUIPMENT STANDARDS

34. In paragraph 71 of the Notice, the Commission requests information on receiver standards. NPSTC notes that receiver standards have been essential to obtaining maximum spectrum efficiency in the NPSPAC band. NPSTC believes that the Commission should make receiver standards mandatory throughout this new allocation. Receiver adjacent channel interference protection ratios are required to analyze interference impacts under the methodolgy established by TIA's TSB 77. **NPSTC recommends the issue of receiver standards be the subject of a Further Notice of Proposed Rulemaking.**

35. The Commission, in paragraph 72 and 73, discusses interoperability channel capability and the concept of "interoperability radios" being developed for this band. NPSTC supports the requirement established in the *NPSPAC Order* that requires all radios to be capable of operating on interoperability channels throughout the design bandwidth of the equipment. We stress that the requirement be capability, not mandated installation, because operational requirements that may be developed by a national plan, al planning may restrict use of some channels. Likewise, the Commission must restrict this requirement to radios and channels of like kind; voice radios should not be required to operate on high speed data interoperability channels and vice-versa.

36. As previously stated, manufacturers have indicated to NPSTC that it is not generally

possible to add channels in this new band into equipment designed for the 806-869 bands. However, to the extent that new equipment is type accepted, we propose that the Commission require interoperability capability across the operational frequency spread of the equipment within the 746-869 MHz bands.

37. The "interoperability radios" proposed by the Commission will be built if there is sufficient use for this application. In designing the proposed band plan, NPSTC carefully placed voice interoperability channels to allow for inexpensive development of this option. We believe this option will draw such users as utilities and organizations such as the Red Cross to this band in which we propose their eligibility only for the use of specific interoperability channels. However, NPSTC cautions the Commission on its belief that availability of such equipment could lead to its widespread distribution within the public safety community. As noted in the PSWAC Final Report, the largest use of interoperability is day-to-day operations. We cannot expect field personnel to carry two radios if they do not have the capability to access the 746-806 band in their dispatch radios. In addition to the requirement for continuous maintenance of the equipment, the time required to deliver them to an in-progress incident often negates their effectiveness.

IX. ELIGIBILITY, USE AND LICENSING

38. NPSTC shares the Commission's belief, in paragraph 75-95 of the Notice, that a formal definition of Public Safety is necessary. It is our opinion that the definitions adopted by PSWAC should be adopted by the Commission. We believe that the language contained in the definition passed by Congress was too limiting in scope and too broad in application. NPSTC

recognizes that a great deal of effort and time was put into the process of crafting these definitions. Representatives of the public safety community were part of this process and this effort should not be ignored. NPSTC strongly recommends that the definitions in the PSWAC Final Report be adopted within this proceeding. **If the legislation prohibits application of the entire PSWAC definition then NPSTC recommends that Congress amend the legislation appropriately**.

> *In its deliberations, the Interoperability Subcommittee and ultimately the Steering Committee adopted the following formal definitions of Public Safety, Public Service, Interoperabilioty, and Mission Critical:*
>
> *Public Safety:*
>
> *The public's right, exercised through Federal, State or Local government as prescribed by law, to protect and preserve life, property, and natural resources and to serve the public welfare.*
>
> *Public Safety Services:*
>
> *Those services rendered by or through Federal, State, or Local government entities in support of public safety duties.*
>
> *Public Safety Services Provider:*
>
> *Governmental and public entities or those non-governmental, private organizations, which are properly, authorized by the appropriate governmental authority whose primary mission is providing public safety services.*
>
> *Public Safety Support Provider:*
>
> *Governmental and public entities or those non-governmental, private organizations which provide essential public services that are properly authorized by the appropriate governmental authority whose mission is to support public safety services. This support may be provided either directly to the public or in support of public safety services providers.*
>
> *Public Services:*
>
> *Those services provided by non-public safety entities that furnish, maintain,*

and protect the nations basic infrastructures, which are required to promote the public's safety and welfare.[5]

The term Public Safety, as defined, extends to all applicable functions of government at the federal, state and local levels, including Public Safety operations on Department of Defense facilities. There are two levels of Public Safety providers. The Public Safety Services Provider definition is focused toward entities performing such duties as emergency first response and similar activities. The Interoperability Subcommittee Workgroup recognized that this particular definition did not adequately cover the diverse Public Safety community and it was necessary to include another level of provider, the Public Safety Support Provider. This was in accordance with question encountered by the Operational Requirements Subcommittee during the process to identify entity-specific needs. The Operational Requirements Subcommittee acknowledged that although a particular organization's primary mission might not fall within the classic Public Safety definition, some aspects of its operations could involve or impact Public Safety services, but which may provide vital support to the general public and/or the Public Safety Service Provider.[6]

The ISC also addressed Public Safety Service Providers that were non-governmental. Properly authorized non-governmental, private organizations performing Public Safety functions on behalf of the government are included in these definitions. The need for this portion of the definition is becoming more evident with the privatization of certain governmental services. For example, a number of local governments contract private organizations for emergency medical and/or ambulance service. Although private, these entities are authorized by the applicable government entity to provide life-saving functions on its behalf. Specific licensing concerns have been surfaced through this mode of operation and will be discussed in a later section of this report.[7]

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5 PSWAC Final Report Volume 1, Interoperability Committee Summary 4.3.2, page 44

6 PSWAC Final Report Volume 1, Interoperability Committee Summary 4.3.2.3, page 44

7 PSWAC Final Report Volume 1, Interoperability Committee Summary 4.3.2.4, page 45

39. For interoperability only, the final determination of who should be included should be left to the planning committees. **NPSTC recommends that licenses in this 24 MHz of this spectrum must be in the name of a governmental entity.** Non-governmental, private organizations, when operating on radio channels licensed to a governmental entity as authorized in accordance with the PSWAC definition above, shall be responsible for compliance with the Commission's rules and regulations. Eligibles of the 24 MHz should be any organization qualifying as a Public Safety, Public Safety Service and Public Safety Support Providers as defined by the PSWAC Final Report.

X. NATIONAL AND REGIONAL PLANNING

40. NPSTC, in general, supports the proposal to utilize an updated version of the planning process and believes that a national plan is the best way to manage the new spectrum to ensure fairness to each and every public safety service. The members of NPSTC, however, have different views as to how the national plan shall be implemented and administered.

41. This new spectrum is virgin to public safety and must provide additional spectrum for all public safety services on an equal basis. This spectrum is required for interoperability, expansion of over crowded systems and for replacement of existing systems which are obsolete. These requirements, while universal, vary greatly from area to area, and therefore flexibility in assignment is an absolute. NPSTC agrees that this must be accomplished under a National Plan format, which would ensure universality in the required areas throughout the nation. The National

Plan should establish the structure of the planning committees and their administrative responsibilities. The Plan should define certain aspects of the channelization scheme, detail how oversight of the planning committees will be accomplished, ensure spectrum efficient channel usage, and provide a framework, with enforcement, for the return of channels that may be replaced through the utilization of the new spectrum. It must provide for a common database platform to maintain the operational specifics of each licensee within the new spectrum. This is an absolute necessity as co-channel users are not isolated from each other and, having many common radio propagation paths, cannot operate totally independent. The planning committees must have representational membership from each of the Public Safety radio services to provide the wide range of input necessary for an effective and balanced review process.

42. As to the fourth option proposed by the Commission, that of creating sub-regions for the purpose of planning the use of the interoperable channels, it requires attending meetings for which travel will be required, which puts an additional burden on already over taxed state and local budgets. As will be discussed later, a funding source remains one of the critical short falls of the existing NPSPAC regional concept. NPSTC believes inter-regional communications can be accomplished on the national channels with planning on a national level.

XI. ELIGIBILITY AND USE OF INTEROPERABILITY CHANNELS

43. NPSTC concurs with the Commission, in paragraph 88 of the Notice, that all Public Safety and Public Safety Services Providers should be eligible to use the interoperable channels. In order to minimize interference between interoperable channels, a procedure for the location of base

stations operating on these channels is recommended. **NPSTC recommends that only the base stations be required to be licensed and their location and manner of use is left to the planning committee's discretion.**

XII. TRUNKING ON INTEROPERABILITY SPECTRUM

44. The Commission, in paragraph 96 of the Notice, concludes that trunking and technical standards must be set by the Commission at the national level. Except as noted below for interoperability trunking, NPSTC agrees with this concept, not just as it applies to interoperability spectrum.

45. The Commission cites, in paragraph 97 of the Notice, the recommendation of the PSWAC ISC suggesting 70 mobile channels and 31 base/mobile channel pairs for interoperability. The Commission indicates that designating a substantial amount of the 741-806 MHz for this purpose can fulfill this requirement. The recommendation from the PSWAC ISC is that the majority of spectrum be found below 512 MHz. The reason for that recommendation is that the majority of State and Local agencies, and all of the Federal government services, operate in bands below 512 MHz. There is a definite lack of interoperable channels set aside for the purposes outlined in this proceeding and the immediate need is to establish a national interoperable plan in the Public Safety bands at VHF and UHF; similar to what is available at 806/824 - 851/869

46. The Commission discusses the assignment of substantial spectrum in this new band for interoperability use, quoting suggested channel numbers from the PSWAC Final Report. As

previously noted, NPSTC disagrees with the Commission on this issue and its interpretation of the PSWAC Final Report. The channel numbers suggested by the PSWAC ISC were for channels in operational bands below 512 MHz where the majority of public safety voice operations continues to reside for the foreseeable future. We note, for example, that almost all law enforcement operations in the Los Angeles and New York metropolitan regions use the 450-512 MHz band and most fire operations nationwide continue to operate in the 150-174 MHz band. Specifically, the PSWAC Report stated that the 2.5 MHz of interoperability spectrum must be below 512 MHz. Appendix A proposes 2 wide band data pairs, 2 digital video pairs, 20 voice pairs and 24 simplex frequencies for interoperability in this band. These numbers were selected to provide a number of channels sufficient enough to handle the day-to-day, mutual aid and task force interoperability needs of users in the 746-869 MHz bands and of those users who choose to purchase interoperability radios.

47. The Commission, in paragraph 101 of the Notice, concludes "that a trunked system is the best, and possibly only practicable, method" by which wireless communications among many personnel from different agencies and regions may be rapidly coordinated in a large scale emergency. **NPSTC strongly disagrees with this conclusion.** Communications for a number of major emergencies are effectively managed each year in the United States, with the primary problem being the lack of usable interoperability spectrum in bands where it is required. There are numerous fiscal, operational and technical problems with the Commissions proposal:

6. Most tactical interoperability today is in the simplex unit-unit operating mode because there

is generally no infrastructure that provides the required coverage and building penetration, or because the communication is local and wider area coverage is not required.

7. All of today's public safety subscriber equipment has a trunking feature set as an added option that is purchased only when that unit needs to access a trunked system. The Commission is proposing to federally mandate the expense of adding the trunking feature set into all state/local subscriber units regardless of whether or not their primary dispatch operation is trunked.

8. Who will pay for and manage the interoperability trunking infrastructure and the required management, operational and maintenance expenses to keep it operational?

9. Operationally, the maintenance of an ID database is a complex, usually full-time operation for larger systems. Unit IDs and encryption keys regularly change as equipment is taken in and out of service for repair or operational needs require changes.

10. The time required to collect and subsequently enter the subscriber IDs and associated talk-groups for each unit responding from out of the immediate area are significant. In the case of today's trunked systems, it is necessary to completely define the new system to the subscriber unit before it can be placed into operation. This can take 10-20 minutes per radio to complete. Radios can not be cloned because each has a unique trunking ID.

XIII. TECHNICAL STANDARD FOR INTEROPERABILITY SPECTRUM

48. In paragraphs 104 -107 of the Notice, the Commission correctly identifies the difficulties of developing a standard. However, these difficulties are generally behind us if the Commission adopts Project 25 Phase I (12.5kHz FDMA) Common Air Interface as the digital baseline for interoperability. It is clear from the Commission's statements in Paragraph 105 of the Notice, that they do not recognize that the Project 25 standards have been developed in the Commission's preferred manner of relying "on equipment manufacturers to develop standards through an appropriate standards association such as the Mobile and Personal Communications Division of the Telecommunications Industry Association (TIA)." The NPRM continues, "Alternatively, the Commission could adopt standards developed by a public safety organization such as APCO Project 25." NPSTC notes that Project 25 was not developed solely by APCO as an organization standard. Rather, it is being developed using the TIA process. Most of the documents (and certainly all critical documents) produced under Project 25 are published by TIA as Technical Service Bulletins (TSB), Interim Standards (IS) or actual TIA Standards. The base document, the Common Air Interface, is now in the process of comment resolution as an American National Standards Institute (ANSI) standard following a vote of 19 to 1 in favor of such adoption by eligible voters.

49. As previously stated, NPSTC believes that, because digital equipment is now available from a number of manufacturers and offers significant advantages over its analog counterpart, many agencies building new systems in this band will employ digital equipment. It is therefore critical that the Commission, as part of this proceeding, adopt a digital baseline for

interoperability.

50. A consensus of the NPSTC member organizations support adoption of the Project 25 Phase I (12.5 kHz FDMA) common air interface as the digital baseline for interoperability for this new band. **Additionally, NPSTC recommends that the Commission require that this baseline be included in all digital subscriber equipment in addition to any other digital operating modes that might be present in the subscriber unit.**

51. The Commission, in paragraph 107 of the Notice, solicits comments regarding the scope of additional standards that might be needed to ensure effective interoperability, specifically mentioning encryption. NPSTC notes that Project 25 includes digital encryption (at security levels up to and including Type I required by federal agencies) as an integral part of the standards suite. Over-The-Air Rekeying (OTAR) which allows encryption keys to be transferred securely over the air between a key manager and subscriber units is also defined within Project 25 as a standardized option.

XIV. GENERAL SERVICE RULES

52. In the context of paragraphs 108 - 123 of the Notice, the existing NPSPAC regional committee operations have highlighted some of the deficiencies that must be addressed in the revision of the National Planning process. Developing a satisfactory process for managing this new spectrum in an efficient and all-inclusive way will be a challenge. Adequate representation from each and every Public Safety discipline is a necessity on every planning committee. Currently, there

is no method for funding these committees. This has been done on a voluntary basis. A solution for funding must be found that, through appropriate financial controls, could be used to offset the planning committee's legitimate and necessary expenses.

53. The present trend in the above 512 MHz frequencies, will, no doubt, continue in the new spectrum is to construct wide area trunked systems. Many, if not most, of these systems incorporate a variety of Public Safety services including public works, general local government, fire, police, etc. They often serve numerous political entities, counties, cities and districts. There are plans for state systems, which will offer service to all levels of government. Planning for these systems must be accomplished on a regional basis as there are, and will continue to be, many variations of systems needed.

54. The Commission is aware that in the top 25 major metropolitan areas of the US, there exists a critical shortage of spectrum. We concur that, where the 746-806 MHz spectrum is available to be utilized immediately, due to a lack of NTSC or newly assigned DTV assignments, a release of a portion of that spectrum for immediate use would definitely be in public safety's best interest.

55. Due to the extreme difference in terrain, with resultant propagation anomalies, mileage separation is not an adequate means of determining frequency reuse. Persons with many years of experience in such matters best accomplish this determination of interference paths on a local level. Modern technology now provides the means to enhance this experience with engineering

programs (such as TR8.8) based on digitized terrain information. This vital technical input must be on-going in the planning and administration process.

XV. TYPES OF COMMUNICATION

56. In the context of paragraphs 127 - 129 of the Notice, the need for data is much greater now than in 1987 when the last spectrum (821/866 MHz) was allocated to public safety. From a transport perspective, image and video is just another form of data transmission. From that standpoint, there are three major types of communications. The types are voice, slow speed (up to 19.2 kbps), and high speed data (384 kbps and higher). This spectrum allocation is large enough to accommodate all three types of communications and it is important to accommodate all three types within the band plan. This reply includes a suggested band channeling plan that accommodates the three types.

57. In the context of paragraph 130 of the Notice, many agencies need additional channels for voice communications as documented in the PSWAC Final Report. Other agencies require a channel for today's state of the art 19.2 kbps mobile data systems. Still others want to develop new high speed data systems that can accommodate image, database applications, video, and other applications that are yet to be developed. The Commission should allow all of these communication types.

58. In the context of paragraph 131 of the Notice, there is some need for full motion "near broadcast quality" video, which the PSWAC Technology Report pointed out requires a T1 (1.544

Mbps) data rate. Few channels with a bandwidth to accommodate this data rate will fit in the 24 MHz allocation. This requirement should be met, to the extent possible, by planning committees as a secondary priority by aggregating high speed data channels. While today a T1 rate is required for full motion video and only a 384 kbps rate can be achieved in a proposed high speed data channel, this will change in the future. Compression algorithms will improve and higher bits per hertz modulation and data coding will allow higher data rates in the channel bandwidth and in the future allow the full motion video to work in the channel bandwidth for high speed data as proposed.

XVI. CHANNEL SPACING

59. The Commission, in paragraph 132 of the Notice, seeks recommendations as to channel spacing in the 746 - 806 MHz band, and suggests that one approach might be to allow the planning committees to have a role in determining the channel assignment spacings. **NPSTC recommends that multiple channel spacings be employed: 12.5 kHz for analog and digital voice and slow speed (9.6 kbps) digital information transmission; 25 kHz for mid-speed (19.2 kbps) digital information transmission; and 150 kHz for high speed (384 kbps) digital information transmission.** In effect the higher channel spacings are actually an integer multiple aggregation of the basic 12.5 kHz spacing, however, channel blocking is recommended for nationwide uniformity, with allowance for modification by planning committees.

60. In the context of paragraph 133 of the Notice, **NPSTC recommends that a uniform national plan, under which planning committees would operate, should incorporate channel blocks for statewide and regional wide area shared use systems, as well as for different width**

digital transmission systems, for interoperability/mutual aid and on-scene tactical channels, and for vehicular repeater channels. Clearly, large shared use systems are more spectrally efficient and enhance interoperability compared to small systems, and the development of such systems takes considerably longer from concept to completion. Factors which are not insignificant in this process are system funding, and the environmental/zoning aspects of tower siting. The latter is quite significant in this frequency band because taller towers perform better for wide area coverage and the quantity of tower sites is greater than for lower frequency bands. For these reasons, to encourage the development of large shared use, spectrally efficient systems, the blocking of channels for this purpose is important.

61. Advanced spectrally efficient technologies may be authorized under a waiver from the present Commission rules by aggregating channels for the required channel width and showing that harmful interference will not occur to other stations. The use of radio system coverage analyses in accordance with the TIA TR8 WG8.8 report (anticipated soon to become a national standard) will serve to ensure freedom from harmful interference between systems, regardless of modulation and channel access method.

62. In paragraph 134 of the Notice, the Commission contemplates a situation where the planning committee might not permit aggregation of channels, and thus would potentially frustrate the implementation of certain wider bandwidth technologies. The Commission may waive certain rules to allow such variations in bandwidth upon a demonstration of spectrum efficiency and non-interference to existing licensed operations. If other aspects of an applicant's proposed operation

are in accordance with the National Plan, the Commission can charge the planning committees with the responsibility to permit use of advanced technology that is more spectrally efficient and does not cause interference to existing licensed and proposed operations. There are many aspects to a National Plan, not the least of which may be the Commission's goal of interoperability.

63. In paragraph 135 of the Notice, the Commission contemplates a different situation where by it establishes an assortment of channels of different sizes. This is generally consistent with the NPSTC recommendation in regard to paragraph 132.

64. In paragraph 136 of the Notice, the Commission considers the marketability of equipment that may not guarantee the availability of a particular channel bandwidth, and whether it should require a single channel width for each type of communication. It is possible that a manufacturer may produce a modulation bandwidth requirement that is not as wide as 150 kHz, but is wider than 25 kHz. Presently designed and manufactured FM equipment in Europe and the United States for voice and digital communication can operate in 12.5 kHz and 25 kHz channel widths, with spectral efficiencies equivalent to 6.25 kHz per subscriber voice channel and digital transmission gross rates of 9.6, 19.2, and 28.8 kbps (with short burst capacity of 38.4 kbps), as in TETRA. Going beyond those digital transmission rates, to reach 384 kbps (¼T-1) in a 150 kHz channel will require improved modulation efficiency beyond that presently available in FM systems used in a multipath (mobile) environment. The final report of the PSWAC Technology Sub-Committee (PSWAC Appendix B - TESC Final Report, Pages 43-45 (233-235), section 6.5 Modulation) indicated that a 3.28 bits/second/hertz spectrum efficiency would be possible shortly.

65. A major goal is to achieve optimum spectrum efficiency. Digital information is transmitted as a function of rate per second and message length, thus reducing the time it takes to receive a complete message. Current NCIC-2000 message type scenarios are published at 4.8 kbps, however shorter message transmission times are desired and faster data rates are being tested. Except for video, where visual image flicker is undesirable, and 384 kbps net digital information rate becomes minimally acceptable. Allowing for necessary error correction, this will require a gross digital information rate approaching 500 kbps for a modulation efficiency of 3.3 in a 150 kHz channel.

66. It would seem therefore, that modulation efficiency should be a significant factor to be considered by the Commission and the planning committees. Similarly, spectrum efficiency in terms of (MB data traffic (busy hour per kHz of spectrum per square mile) should be of concern. Inefficient systems should score lower in a competitive application filing window. Certain minimum standards may need to be established to ensure that both manufacturers and public safety licensees have an incentive to be spectrally efficient.

67. The Commission, in paragraph 137 of the notice, proposes that all interoperability channel spacing should follow the recommendations presented in paragraphs 61 - 66 of the notice. The suggestion is that interoperability channels in 746 - 806 should be 25 kHz wide so as to provide for use by embedded base equipment in 806-824/851-869 MHz. Inasmuch as there is no embedded base equipment capable of operating in the 746 - 806 MHz band, this rationale is invalid.

68. In paragraph 63 of the Notice, the Commission picks up on the PSWAC ISC recommendation for the 16K0F3E emission for interoperability. However, this has been taken out of context. [The context was intention of the recommendation for existing bands in which there is an embedded base of wideband FM equipment, for which the Commission has not set a date certain for termination of its type acceptance.] It is necessary to establish a baseline by which these existing radios can interoperate. It also allowed other baseline emissions for embedded base equipment in other bands, such as 220 MHz where 5 kHz linear modulation is used. The baseline emission for such bands would be as currently authorized by the Commission. Further, PSWAC ISC said that for any new bands, which the Commission may allocate to Public Safety, the baseline emission would be as authorized for operational communications in that new spectrum.

> *It is the recommendation of the Interoperability Subcommittee that the minimum Baseline Technology for Interoperability, for unit-to-unit voice communication, be 16K0F3E (analog FM), unless Federal Communications Commission (FCC) and/or National Telecommunications and Information Administration (NTIA) regulations stipulate a different emission in a specific operational band. This mandatory requirement should be adopted as soon as possible by the FCC and NTIA. This recommendation is applicable public safety spectrum between 30 MHz and 869 MHz.*
>
> *Effective January 1, 2005, the minimum Baseline Technology for Interoperability, for unit-to-unit voice communication, should be mandated as 11K25F3E (analog FM) in public safety spectrum between 30 MHz and 512 MHz, unless FCC and/or NTIA regulations stipulate a different emission in a specific operational band.*
>
> *The maximum allowable interoperability bandwidth in any new spectrum allocation should not be allowed to exceed the bandwidth established for operational communications within that new spectrum*[8].

[8] PSWAC Final Report. Appendix C: Interoperability Subcommittee Final Report, ISC Work Group Ten 12.10.6 Recommendations, page 210(484).

Ref: Section 12.10.6 Recommendation, PSWAC Appendix C - ISC Final Report, Page 210 (484).

69. Furthermore, the comparison to NPSPAC mutual aid channels for channel spacing is invalid because the NPSPAC block of channels, except for mutual aid, was based on a 12.5 kHz spaced interstitial, geographically offset assignment of 14K0F3E emission channels (essentially a 25 kHz bandwidth receiver operating at 4 kHz maximum deviation with a reduced bandwidth modulator emission mask). The embedded base of 25 kHz channel width mobile radios in 806-821/851-866 was permitted to operate on these mutual aid channels without further licensing. For this reason, the mutual aid channels were 25 kHz.

70. There is no land mobile radio equipment designed for operation on 746-806 MHz. As referenced above PSWAC ISC, *The quotes maximum allowable interoperability bandwidth in any new spectrum allocation should not be allowed to exceed the bandwidth established for operational communications within that new spectrum.* Therefore, for single channel voice communication, which is most prevalent for interoperability, 11K25F3E for analog and 11K25F2E for digital is recommended by NPSTC. (PSWAC used 11K25 emission bandwidth, which does not conform to the FCC field definition for describing emission bandwidth, 47 CFR 2.202.)

71. Regarding digital information systems at various data rates and channel widths, there is much more involved than just the channel width. The modulators must be similar format, and the information and error correction coding and formatting must be identical. Until such standards are

established, interoperability will be ineffective for digital communication. In the case of digital voice, there must be a commonality of vocoder, encryption standard (optional), digital information and error correction format, and at least a similar modulation format. For these reasons a digital baseline standard for interoperability is required.

72. It can be expected that existing 806-824/851-869 MHz systems that require expansion channels in 746-806 MHz will continue to use whatever digital standards they currently employ. New radio equipment will be able to adapt to the channel plan and emissions to be determined by this proceeding. However, to expect such equipment to operate in a totally foreign digital mode of operation is not likely to happen in the short term. **Therefore, NPSTC recommends that the Commission adopt the 11K3F3E analog emission standard for interoperability channels on 12.5 kHz channel spacings as the baseline. NPSTC also recommends the adoption of Project 25 (Phase I) single channel digital voice operating at 11K3F2E emission on 12.5 kHz channel spacing as a digital option on interoperability channels.** Project 25 radios are backward compatible to analog. NPSTC further recommends that other types of digital interoperability be considered in a future notice of proposed rulemaking.

73. While the Commission notes that full motion video will ostensibly require a T-1 (1.5 Mbps) bandwidth, and full motion video was listed in the PSWAC final report, it is not necessarily appropriate that such wideband channel capacity be accommodated in 746-806 MHz. Other frequency bands would be more appropriate for this application. It is expected that The planning committees will prioritize the need for channels.

74. This is further supported by comments from FEMA's Spectrum Manager: A great deal of input has been submitted with regard to video and data requirements on the mutual aid channels. In our experience, command-and-control voice communications between responding agencies is the element most critical to a successful operation. While video and data can, most certainly, enhance operations, it should be supported by the Commission only after providing enough voice channels. In addition, the Commission should also be aware that in FEMA's experience, single-frame video shots are preferable to slow-scan or live video when attempting to do damage assessment from airborne platforms. However, there are areas where full motion video has been demonstrated to be essential to the assessment of certain situations.

75. Because the need for voice channels may be so great in a particular area, it is NPSTC's recommendation that planning committees should have the authority to establish the quantity of channels to be used for wide bandwidth applications.

XVII. CHANNEL REQUIREMENTS

76. **In the context of paragraphs 140 - 152, NPSTC recommends that the Commission adopt Approach 3 as detailed in paragraph 147 of the Docket**. This approach provides a reasonable amount of flexibility within the planning process without allowing unrestricted assignment of the spectrum. It offers a good compromise between the extremes of no control in Approach 1 and full control in Approach 2.

77. Approach 1 certainly affords the planning committees maximum flexibility to assign spectrum as needed to meet the requirements of agencies within their area. However, it also creates a coordination problem that may well lead to significant conflicts between adjoining areas Experience has shown that reuse patterns are significantly improved when co-channel users utilize a channel in a like manner with similar technologies. Technological solutions such as selective signaling may not be available if the affected parties are using dissimilar technologies. Similarly, operational solutions such as the sharing of a common system are available only in situations where there is significant compatibility between the use of the spectrum. Conflicts between dissimilar users often result in one party being affected more than another. Such a situation may negatively impact the "desire" of the parties to find an equitable solution to the problem. Approach 1, therefore, is undesirable since it is likely to result in dissimilar usage patterns along jurisdictional borders that may result in conflicts between the users in each area and limit the effective assignment of the spectrum.

78. Approach 2, on the other hand, provides no flexibility for jurisdictions to adjust spectrum usage based upon local demand. Such an approach is likely to result in one portion of the spectrum lying fallow while individual agency needs, which lie within another portion of the spectrum, go unmet due to localized congestion within that portion of the spectrum.

79. While Approach 3 offers some of the flexibility of Approach 1 and, therefore, some of the coordination problems identified above, it does so in a structured environment that is more likely to encourage cooperation between jurisdictions. At the very least, any proposal by one area

to either aggregate or disaggregate various channels will be a flag for adjoining jurisdictions to consider the impact of such proposals upon their own area.

XVIII. TRANSMISSION TECHNOLOGY

80. In the context of paragraphs 153 - 158 of the Notice and as the PSWAC Final Report states - "Digital technology will be the key technology for the future." Adopting a digital standard now will facilitate the creation of digital systems. The future migration to 6.25 kHz voice channels will be easier if a digital standard that is intended to also migrate to 6.25 kHz is adopted for this band. The digital technologies are maturing now for 12.5 kHz bandwidths. Many agencies implementing new systems in other bands are opting for digital systems.

XIX. TECHNICAL PARAMETERS (EMISSIONS ETC.,)

81. In the context of paragraphs 160 - 162 of the Notice, NPSTC has made the following recommendations for channel bandwidths for this allocation. The spectrum should generally use the VHF/UHF refarming data efficiency standards.

Integrated voice/data =0.768 bits/Hz raw data rate

One (1) voice circuit per 12.5 kHz of spectrum bandwidth

12.5 kHz emission mask D

Fd = 0-5.625 kHz	attenuation = 0 dB
Fd = 5.625-12.5 kHz	attenuation = 7.27(Fd-2.88 kHz) dB
Fd = 12.5 kHz	attenuation = lower of 50 + 10*log(P) or 70 dB